CONTOUREDUCATION

VCE Specialist Mathematics ½
Further Proof Techniques [2.2]
Test

20 Marks. 22 Minutes Writing.

Results:

Test Questions	_____ / 20

Section A: Test Questions (20 Marks)

Question 1 (4 marks)

Tick whether the following statements are **true** or **false**.

Statement	True	False
a. De Morgan Law says that $\neg(A \vee B) = \neg A \vee \neg B$.		
b. Contrapositive statement of "if you are a Contour student then you will enjoy learning maths" is given by "if you enjoy learning maths then you are a Contour student".		
c. Proof by contradiction requires assuming that the contradicting statement is true.		
d. Equivalent statement is when a statement and its converse are both true.		
e. Universal statements can be proven by simply giving an example within the set.		
f. To disprove an existence statement, you prove the universal statement with the opposite conclusion.		
g. In proof by induction, you can assume that $P(1), P(2), P(3), \dots P(k)$ is true and from there, prove that $P(k) \rightarrow P(k + 1)$.		
h. Induction proof can be done for when k is all real numbers.		

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Question 2 (4 marks)

Let $n \in N$. If $5^n - 1$ is prime, then n is odd.

a. Write down the contrapositive of the statement. (1 mark)

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b. Prove that the contrapositive is true. (3 marks)

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Question 3 (3 marks)

Prove that if x is irrational then, $\sqrt{x+1}$ is irrational. Use the contradiction method in your proof.

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Question 4 (4 marks)

Prove that the following is true for all positive integers n: n is odd if and only if $3n^2 + 8$ is odd.

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Question 5 (5 marks)

Prove that $\frac{1}{1\times3} + \frac{1}{3\times5} + \frac{1}{5\times7} + \cdots + \frac{1}{(2n-1)(2n+1)} = \frac{n}{2n+1}$ for all $n \in N$.

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VCE Specialist Mathematics ½

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